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Civil Engineering



**AIRCRAFT FIRE PROTECTION FOR
EXERCISES AND CONTINGENCY
RESPONSE OPERATIONS**

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This pamphlet provides planners guidance for contingency response operations lasting a maximum of 120 days. Planners use this guidance to determine the minimum number of Fire Emergency Services (FES) aircraft rescue and fire fighting (ARFF) manpower and vehicles necessary to provide fire suppression for Air Force (AF) aircraft during major exercises and real world contingencies. These operations may include exercises for training purposes, disaster response, humanitarian relief operations, or other non-combat type operations. Determining requirements is based on the type and size of aircraft being protected. For the purposes of this document, applicable AF ARFF vehicle sets and requirements are found in Allowance Standard (AS) 019, *Vehicle Fleet (Registered) All MAJCOM Common*, based on National Fire Protection Association (NFPA) Standard 403, *Aircraft Rescue and Fire Fighting Services at Airports*, AF NFPA 403, *Technical Implementation Guide* and the *Vehicle Validation and Realignment Plan*. These sets are used as a baseline and modified to meet exercise and contingency requirements. The capabilities outlined in this pamphlet provide ARFF fire suppression and limited rescue capability, but do not include structural fire protection or other emergency response capabilities. This guidance applies to all AF Active, Reserve, and Guard Civil Engineer (CE) units. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with AFMAN 33-363, Management of Records, and disposed of in accordance with (IAW) the Air Force Records Disposition Schedule (RDS) located at <https://www.my.af.mil/gcss-af61a/afrims/afrims/>. Refer recommended changes and questions about this publication to the Office of Primary Responsibility using **AF Form 847, Recommendation for Change of Publication**; route **AF Form 847s** from the field through Major Command (MAJCOM) publications/forms managers.

SUMMARY OF CHANGES

This document has been substantially revised and must be completely reviewed. This revision changes the title from Aircraft Fire Protection for Military Operations Other than War; implements new USAF FES vehicle sets with the Vehicle Validation and Realignment Plan, no longer bases ARFF requirements on the Maximum on Ground, disconnects manpower from vehicles, incorporates level of service terms and other changes contained in Air Force Instruction (AFI) 32-2001, Fire Emergency Services Program.

1. Scope. This pamphlet provides guidance for operations lasting a maximum of 120 days and is used for small scale operations. It does not apply to long term ongoing operations or war. FES guidance for those requirements is found in AFI 32-2001 and the *War and Mobilization Plan (WMP) 1, CE Supplement, Appendix 5*.

2. Responsibility. The aircraft user provides ARFF capability at locations other than established AF installations. If the aircraft user cannot provide the minimum ARFF capability listed in **Table 1** and **Table 2**, the user requests support through Air and Space Expeditionary Force Operations (AEFO) or the aircraft provider's MAJCOM Director of Operations. In this case the user may be responsible for providing funding.

3. Risk Management. Fire fighting capability is dependent on two primary resources – fire fighting agent and personnel - discussed separately in paragraphs **4** and **5** below. An assumption that only one major fire incident will occur at the same time always exists. This document approaches risk management from a perspective of requiring the local risk managers to determine the acceptable levels of risk based on local risk factors. Generally, local risk factors include historic fire experience (if available), type and duration of the operation.

3.1. The maximum length of time this document covers is 120 days in any one-year period. For operations that exceed 120 days, arrangements need to be made for a permanent FES capability as prescribed in AFI 32-2001 (permanent installations) or WMP 1, *CE Supplement, Appendix 5* (deployed locations).

3.2. In principle, the shorter the exposure time, the lower the risk. Theoretically operations of very short duration present lower risk than operations approaching 120 days. This exposure time should be a factor when deciding FES resources needed for such operations.

3.3. ARFF capability is dependent on the agent and personnel available to conduct operations at an incident scene. Capability for each primary resource (agent and personnel) is described as optimum level of service (OLS), reduced level of service (RLS) or critical level of service (CLS). Overall FES capability is the lowest level of service available for either resource. For example, when agent is OLS and personnel are CLS, the overall capability is CLS.

3.4. The fundamental purpose of fire fighting operations is to save lives and property. Therefore; the primary resources needed to deliver the various levels of service are calculated based on scenarios that may be encountered. OLS is the highest level of service because it provides capability to perform rescue from a large fire (exterior and interior) involving an aircraft. Resources are provided to knock down, extinguish or control the exterior fire and fight interior fire enabling rescue to be performed. OLS provides the highest probability of successful rescue. Conversely, if CLS is provided fire crews would not be expected to

perform rescue from a large fire scenario. They may be successful in extinguishing a small fire on one side/one location or perform rescue from a fighter-type aircraft. However, these operations would have to be prioritized since they would not have capability to perform these operations simultaneously.

3.5. Saving lives is always the first objective. The importance of saving property diminishes as the fire grows. Fire crews focus on early intervention so they can intervene in time to avoid major damage. When early intervention does not occur it is not possible to save property. For example if an aircraft crashes firefighters cannot prevent property loss. On the other hand, if an engine fire occurs and fire crews arrive quickly, they can prevent the loss of the aircraft.

3.6. In determining the level of service desired it is necessary to anticipate the most probable fire scenario. Historically, large fires are very rare. Although large fires sometimes occur they are normally the result of crashes or explosions, the consequences of which would probably not be influenced by additional FES capability. The most probable fire scenario is a fire at one location on an aircraft with no rescue required. CLS provides the minimum capability to manage such events.

3.7. The three elements of risk assessment are probability, severity, and exposure. Probability involves using historical data to determine the likelihood an event will occur. Severity involves a subjective assessment of how severe the fire will be if it does occur. Exposure is a subjective assessment of the potential impact of the exposure (value of the material exposed and the time exposed) realizing that risk increases over time. Generally the probability of an ARFF fire is very low and the probability of a large fire is extremely low. Aside from crashes or explosions the severity of a fire is minimized by early intervention to prevent fire growth. Response time standards ensure early intervention by fire crews. Although fire safety standards make it unlikely a major fire will occur, local risk factors that can impact any of the three risk elements must also be factored in. For example, mission impact of even a small fire on a B-2 may have significantly more impact than a small fire on a C-130.

4. ARFF Fire Fighting Agent Required. Local risk managers must determine the quantity of agent required based on the risk assessment discussed in paragraph 3 above. The quantities discussed in this document may be less than that available at permanent installation due to the short exposure time (less than 120 days). The quantity of agent available represents 50 percent of the total ARFF capability. The other 50 percent is personnel which are addressed in paragraph 5.

4.1. The amount of agent required is based on the size of the aircraft. Aircraft are grouped into 6 “ARFF Vehicle Sets” described in **Table 1**. Fire fighting agent is delivered by ARFF vehicles with capacities of 500, 1,000, 1,500, 3,000 or 3,300 gallons. **Table 1** indicates the quantity of agent required for various levels of service. Ideally the quantity of agent required to provide the OLS should be provided however; for short-duration operations a RLS or CLS may be provided.

4.1.1. OLS capability represents the amount of agent needed to execute rescue operations at large fires (exterior and interior) involving aircraft. OLS provides sufficient agent for quick knockdown of exterior fires (one minute) (Q_1), continued control of the exterior fire after the first minute or complete extinguishment (Q_2), and agent to support hose

lines for interior fire fighting and rescue operations (Q₃). OLS provides reasonable expectation of successful rescue where large fires are involved.

4.1.2. RLS capability represents the amount of agent needed to execute rescue operations at substantial fires at one location of an aircraft. Sufficient agent is provided for exterior fire control for one minute and enough continued control of the fire after the first minute or complete extinguishment of the exterior fire. This level of service represents increased risk/loss potential due to lack of sufficient agent to perform rescue and simultaneously conduct both interior and exterior fire fighting. A rescue operation is not expected from catastrophic fire situations where simultaneous interior and exterior fire attack is required.

4.1.3. CLS capability represents the amount of agent needed to execute rapid intervention at small fires at one location of an aircraft. At this level of service aircraft interior rescue is not expected to be successful. This level of service represents increased risk/loss potential due to the lack of sufficient agent to maintain control of exterior or interior fire long enough to conduct interior rescue operations. Rescue may still be possible from fighter-type aircraft where interior fire fighting operations are not needed.

4.2. Regardless of available manpower, CLS agent in [Table 1](#) represents increased risk to aircrews and reduces the probability that the fire can be extinguished. The RLS column is a safer alternative and provides increased capability. CLS is the minimum level of agent acceptable and should be limited to very short duration operations. This level of protection is necessary before operations begin.

4.3. For aircraft not listed in [Table 1](#), see AS 019 to determine the aircraft category and AF vehicle set. For more information regarding risk management see AFI 32-2001.

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Table 1. Fire Fighting Agent Requirements.

USAF ARFF Vehicle Set	NFPA Airport Category	Typical USAF Aircraft	OLS (gallons)	RLS (gallons)	CLS (gallons)
6	10	C-5A/B	12,626	7,508	2,589
5	9	E-4, VC-25, MD-11, 747, 777, KC-10	8,792	6,292	2,330
4	8	B-1, B-2, B-52, C-17, C-141, E-3A, KC/EC-135, 767, C-727	6,864	4,364	1,732
3	6 & 7	AC-130, B-1, C-9, C-22, C-32, C-37, C-40, C-130, E-3, E-8, MH53, T-43, VC-137	4,585	3,335	1,456
2	5	C-20	2,563	1,316	752
1	1-4	A-10, BQM-34, C-12, C-21, CV-22, C-38, F-15, F-16, F-22, F-117, HH60, T-1, T-37, T-38, T-6, UH-1, UV18, and U-2	1,125	526	334

4.4. FES planners should select the largest vehicles available to minimize the number of drivers required to operate them.

4.5. The capacity of vehicles equipped with Ultra High Pressure (UHP) technology may be increased by a factor of 3. UHP is 3 times more efficient than low pressure delivery systems. For example a 1,500 gallon vehicle equipped with UHP may be considered equivalent to 4,500 gallons capacity.

4.6. Commanders should consult with the MAJCOM or Area of Responsibility fire chief to establish capabilities for operations not addressed in this document.

4.7. A minimum of two vehicles are recommended for all locations in case of vehicle failure.

4.8. Required agent may be provided in water tankers so long as at least one ARFF vehicle with turret capability is also provided.

4.9. When operating at locations with multiple types of aircraft the largest aircraft determines the ARFF requirement.

4.10. When the required capability is temporarily not available due to unavoidable circumstances for periods less than three days, the Fire Chief will establish a risk management plan and provide this to the responsible commander. The Fire Chief develops operational risk management (ORM) plans if required for the Commander.

5. Personnel Requirements. The previous paragraphs discussed agent required. This section specifies manpower required to accomplish tasks required to achieve OLS, RLS and CLS. Note these planning factors provide a number of firefighters for a given operation. However; once deployed for operations it is the fire chief or senior fire officer's responsibility to determine how their firefighters will be employed.

Table 2. Manpower Requirements.

ARFF SET	RIT	DRIVER	SEARCH RESCUE	INTERIOR HOSE	INTERIOR HOSE	EXTERIOR HOSE	SAFETY	IC	TOTAL
6 OLS	2	*	4	2	2	1	1	1	13
6 RLS	2	*	2	2		1		1	8
6 CLS	2	*	2	1		1		1	7
5 OLS	2	*	2	2	2	1	1	1	11
5 RLS	2	*	2	2		1		1	8
5 CLS	2	*	2	1		1		1	7
4 OLS	2	*	2	2		1	1	1	9
4 RLS	2	*	2	2		1		1	8
4 CLS	2	*	2	1		1		1	7
3 OLS	2	*	2	2		1	1	1	9
3 RLS	2	*	2	1		1		1	7
3 CLS	2	*	2	1				1	6
2 OLS	2	*	2	1				1	7
2 RLS	2	*	2	1	1				6
2 CLS	2	*	2					1	5
1 OLS		*	2	2				1	7
1 RLS		*	2	1				1	5
1 CLS		*	2					1	3

*Add one driver per ARFF vehicle required to deliver the required agent.

Note 1: Add vehicle operators to the total column in [Table 2](#).

Note 2: [Table 2](#) provides manpower for one 24-hour period. For operations exceeding 24-hours manpower must be doubled.

Note 3: Incident Commander (IC) position may be cross-manned when the level of service requires two vehicles or less. The dual role allowance should not degrade the total personnel requirement in [Table 2](#).

Note 4: Where a safety and accountability officer is not provided, the roles are assumed by the IC.

5.1. If structural fire protection is required, consult with the AOR or MAJCOM fire chief to provide appropriate structural fire protection requirements. This can be provided by adding structural firefighting vehicle(s). Cross-manning should be used to minimize the need for additional personnel.

5.2. AFI 11-299, *Nuclear Airlift Operations*, requires a minimum of one AF P-19 or equivalent and manpower for locations where aircraft carrying special weapons are operated, loaded or unloaded. This is required regardless of the number of takeoffs and landings occurring.

6. Exceptions. The responsible commander may exclude fire protection for infrequent flying operations including:

6.1. USAF Vehicle Set 4 through 6: Not more than two takeoffs and two landings within seven consecutive days.

6.2. USAF Vehicle Set 1 through 3: Not more than four takeoffs and four landings within seven consecutive days.

7. Adopted Forms.

AF Form 847, *Recommendation for Change of Publication*

LOREN M. RENO, Lt Gen, USAF
DCS/Logistics, Installations, and Mission Support

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

AFI11-299, *Nuclear Airlift Operations*, 19 March 2008
AFI32-2001, *Fire Emergency Services Program*, 9 September 2008
AFMAN 33-363, *Management of Records*, 1 March 2008
AS 019, *Vehicle Fleet (Registered) All MAJCOM Common*, 2008
WMP-1, *CE Supplement, Appendix 5*, May 2008
NFPA 403, *Standard for Aircraft Rescue and Fire Fighting Services at Airports*, Edition 2009
AF NFPA 403 *Technical Implementation Guide*, 1 December 2004

Abbreviations and Acronyms

AEF—Air and Space Expeditionary Forces
AEFO—AEF Operations
AF—Air Force
AFI—Air Force Instruction
AFMAN—Air Force Manual
AFRIMS—Air Force Records Information Management System
ANG/A3—Air National Guard Director of Operations
AOR—Area of Responsibility
ARFF—Aircraft Rescue and Fire Fighting
AS—Allowance Standard
CE—Civil Engineer
CLS—Critical Level of Service
FES—Fire Emergency Services
AFCESA—Air Force Civil Engineer Support Agency
IAW—In Accordance With
IMT—Information Management Tool
MAJCOM/A3—Major Command Director of Operations
NFPA—National Fire Protection Association
OLS—Optimum Level of Service
ORM—Operational Risk Management
RDS—Records Disposition Schedule

RIV—Rapid Intervention Vehicle

RLS—Reduced Level of Service

WMP—War Mobilization Plan

Terms

Aircraft Rescue Fire Fighting (ARFF) Vehicle—A vehicle intended to transport personnel and equipment to the scene of an aircraft emergency for the purpose of rescuing occupants and conducting rescue and firefighting operations. ARFF vehicles are equipped with at least one external turret that enables rapid agent application without exposing personnel.

Critical Level of Service (CLS)—The absolute minimum level of FES capability available at a given time. This level of service is only acceptable for short durations and should not be diminished.

National Fire Protection Association (NFPA)—An international organization that publishes codes, standards, recommended practices, and guides through a consensus process approved by the American National Standards Institute.

Optimum Level of Service (OLS)—The maximum level of service that can be continuously provided. During OLS, firefighting forces are capable of providing all services continuously throughout an event with reasonable expectation of successful offensive fire attack operations, search and rescue, and property conservation.

P—18—2000-gallon water tanker. Normally used for resupply of ARFF vehicles at locations without adequate water supplies. Also provides limited structural fire protection capability.

P—19—1,000/1,500-gallon agent capacity.

P—22—Two wheel drive structural fire fighting pumper. Normally used to provide structural fire protection capability at locations with adequate water supplies or hydrant systems.

P—23—3,300-gallon agent capacity.

P—24—Four wheel drive structural fire fighting pumper. Normally used to provide structural fire protection capability at locations with adequate water supplies or hydrant systems.

P—26—5000-gallon water tanker. Normally used for resupply of ARFF vehicles at locations without adequate water supplies. Also provides limited structural fire protection capability.

Quantity 1 (Q1)—Water requirements to control an exterior fire for one minute.

Quantity 2 (Q2)—Water required to maintain control or extinguish the remaining exterior fire or both.

Quantity 3 (Q3)—Water requirement for interior fire fighting.

Rapid Intervention Vehicle—500 gallon agent equivalent capacity.

Reduced Level of Service (RLS)—The level of FES capability that exceeds the critical but is less than the optimum level of service.

Risk Manager—The technique or profession of assessing, minimizing, and preventing accidental loss to a business, as through the use of insurance, safety measures, etc.